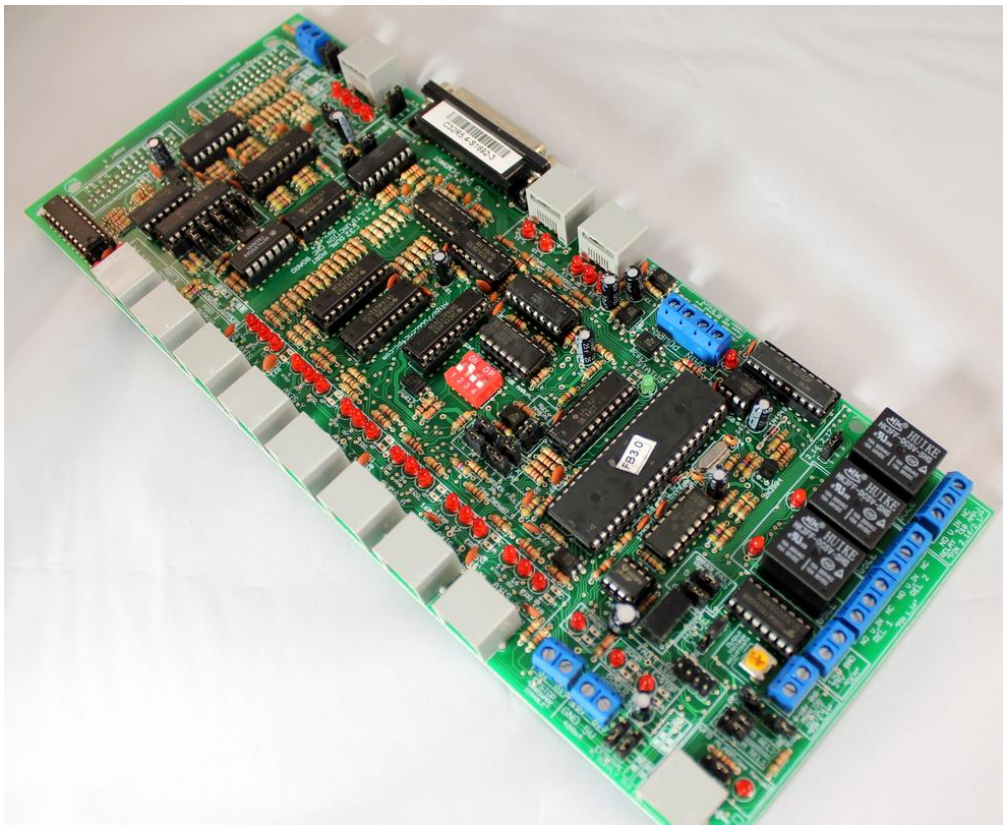
CNC4PC

Integration Solutions for CNC Projects

USER'S MANUAL

C32- DUAL PORT MULTIFUNCTION CNC BOARD Rev. 5



JULY, 2013

USER'S MANUAL

TABLE OF CONTENTS

Page #

Contents

1.0 FEATURES 1

2.0 SPECIFICATIONS 2

3.0 BOARD DESCRIPTION 3

4.0 POWER TERMINALS AND CONFIGURATION JUMPERS 3

4.1 Power terminals and configuration Jumpers for inputs 3

4.2 Power terminals and Jumper for Driver monitor circuit 4

4.3 Controller selection jumpers (IEEE1284/SS) 4

4.4 Driver Fault Jumpers 5

5.0 CONFIGURATION DIPSWITCH 6

5.1 Position 1 6

5.2 Position 2 6

5.3 Position 3 and 4 8

6.0 LED INDICATOR 9

7.0 VARIABLE SPEED CONTROL 9

7.1 Operation Mode Selection Jumper 10

8.0 PINOUT 17

9.0 WIRING SAMPLE 18

10.0 CONNECTING A PENDANT 19

11.0 CONNECTING A C48 20

12.0 WIRING DIAGRAMS 20

13.0 DIMENSIONS 24

1.0 FEATURES

- **Connects directly to the Smooth Stepper (from Warp9).**
- **IEEE 1284 Standard compatible.**
- **Built-in PWM-Based Speed Control.**
- **Built-in Isolated DC-DC converter for analog output voltage.**
- **Two Built-in Electro mechanical Relays with NO and NC positions for spindle control.**
- **RJ45 Connector for Easy VFD Connection.**
- **Monitors E-Stop, Safety Charge Pump and Drivers.**
- **Monitors VFD alarm signal.(NEW)**
- **Enables and disable the drivers.**
- **Electromechanical Relay with NO and NC positions for general purpose (Pin 2_16 or Pin 2_17, jumper-selectable).**
- **Microcontroller based SCHP.**
- **RJ45 connectors for all I/Os.**
- **Easy Connections with CNC4PC relay boards and speed control boards.**
- **Connects 4 and 6 axis pendants (MPG2, MPG12, and MPG8)**
- **Optoisolated inputs.**
- **Works with regular parallel ports.**
- **All TTL 5VDC signals.**

- **Buffered outputs.**
- **Status LEDs on all inputs and output connections.**
- **Works directly with popular CNC hardware and software.**
- **34 inputs and outputs on 2 ports.**

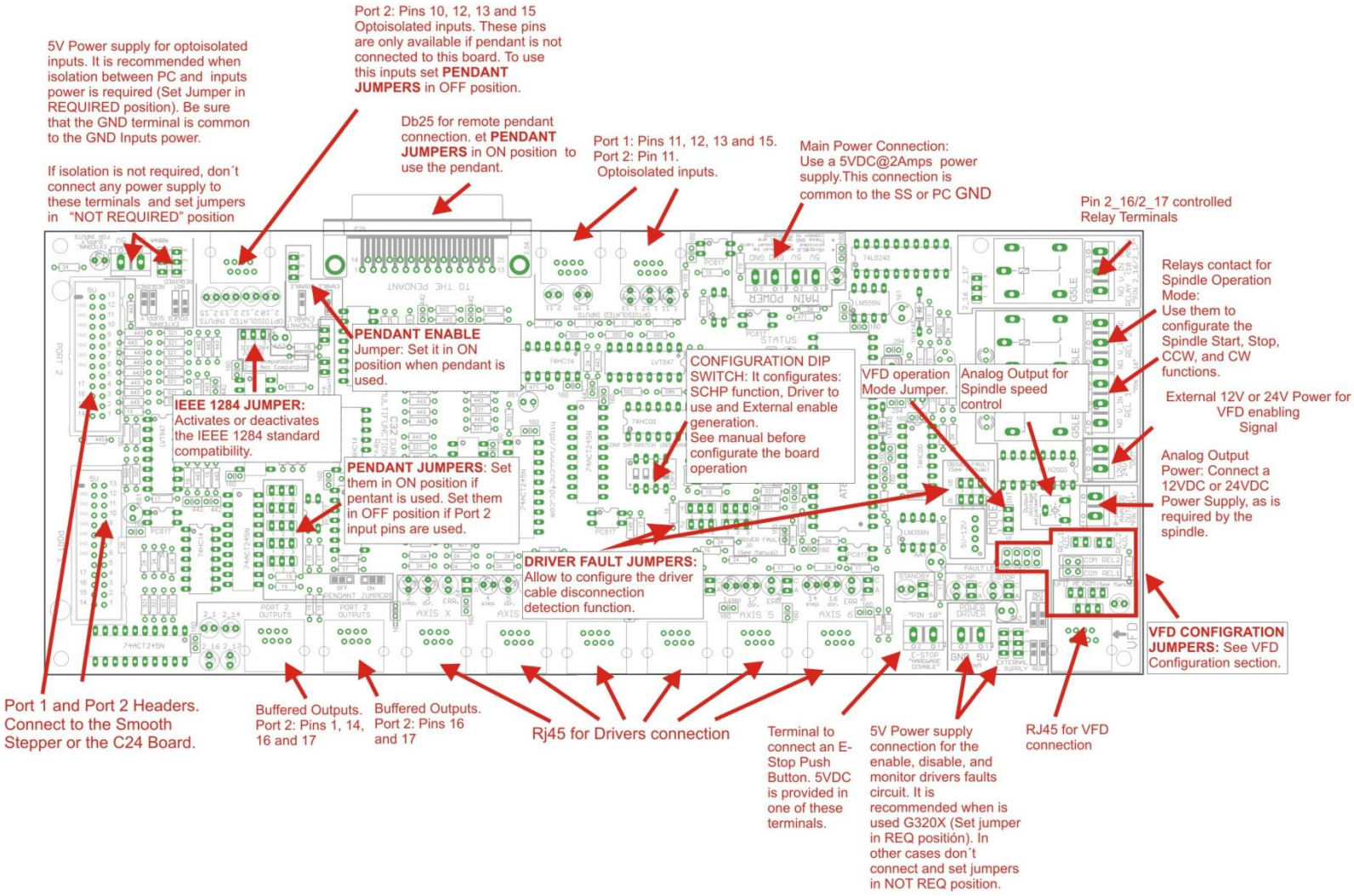
PINS	PORT1	PORT2	TOTAL
INPUT	5	12	17
OUTPUT	13	4	17
TOTAL	18	16	34

2.0 SPECIFICATIONS

OPTOISOLATED DIGITAL INPUT SPECIFICATIONS	
Numbers of inputs	18
On-state voltage range	2 to 5V DC
Maximum off-state voltage	0.8V
Typical signal delay	2.8uS

DIGITAL OUTPUT SPECIFICATIONS	
Number of outputs	16
Maximum output voltage	(5V power supply voltage) + 0.5V
Typical output current	24mA
Maximum off-state voltage	0.44 V
Maximum supported frequency	4M
Typical signal delay	10 nS
Time of transition to high impedance state	120mS*

3.0 BOARD DESCRIPTION

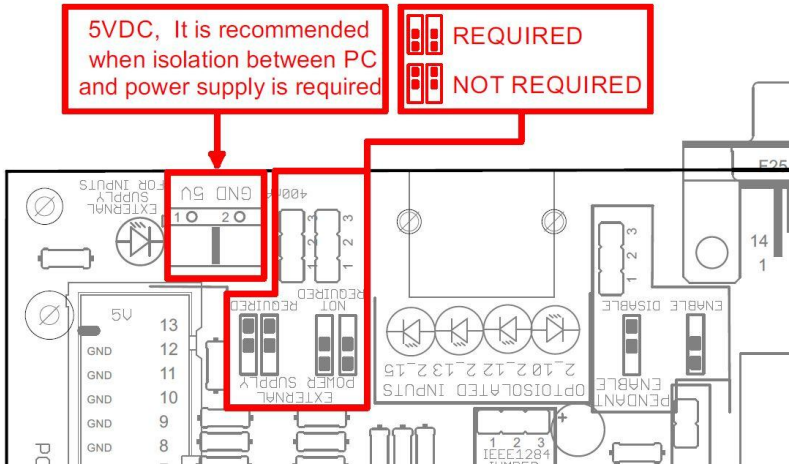

5V Power supply for optoisolated inputs. It is recommended when isolation between PC and inputs power is required (Set Jumper in REQUIRED position). Be sure that the GND terminal is common to the GND Inputs power.
If isolation is not required, don´t connect any power supply to these terminals and set jumpers in "NOT REQUIRED" position
Port 2: Pins 10, 12, 13 and 15 Optoisolated inputs. These pins are only available if pendant is not connected to this board. To use this inputs set PENDANT JUMPERS in OFF position.
Db25 for remote pendant connection. et PENDANT JUMPERS in ON position to use the pendant.
Port 1: Pins 11, 12, 13 and 15. Port 2: Pin 11. Optoisolated inputs.
Main Power Connection: Use a 5VDC@2Amps power supply.This connection is common to the SS or PC GND
Pin 2_16/2_17 controlled Relay Terminals
Relays contact for Spindle Operation Mode: Use them to configurate the Spindle Start, Stop, CCW, and CW functions.
External 12V or 24V Power for VFD enabling Signal
Analog Output Power: Connect a 12VDC or 24VDC Power Supply, as is required by the spindle.
PENDANT ENABLE Jumper: Set it in ON position when pendant is used.
IEEE 1284 JUMPER: Activates or deactivates the IEEE 1284 standard compatibility.
PENDANT JUMPERS: Set them in ON position if pentant is used. Set them in OFF position if Port 2 input pins are used.
CONFIGURATION DIP SWITCH: It configurates: SCHP function, Driver to use and External enable generation. See manual before configurate the board operation
VFD operation Mode Jumper.
Analog Output for Spindle speed control
DRIVER FAULT JUMPERS: Allow to configure the driver cable disconnection detection function.
VFD CONFIGRATION JUMPERS: See VFD Configuration section.
Port 1 and Port 2 Headers. Connect to the Smooth Stepper or the C24 Board.
Buffered Outputs. Port 2: Pins 1, 14, 16 and 17
Buffered Outputs. Port 2: Pins 16 and 17
Rj45 for Drivers connection
Terminal to connect an E-Stop Push Button. 5VDC is provided in one of these terminals.
5V Power supply connection for the enable, disable, and monitor drivers faults circuit. It is recommended when is used G320X (Set jumper in REQ positión). In other cases don´t connect and set jumpers in NOT REQ position.
RJ45 for VFD connection

4.0 POWER TERMINALS AND CONFIGURATION JUMPERS

Before connecting the power supplies, follow steps below.

4.1 Power terminals and configuration Jumpers for inputs

These opto-isolated inputs require an external 5VDC to be powered. It is recommended when isolation between PC and power of inputs is required (set jumpers in REQUIRED position). Be sure that the GND terminals are common to the GND inputs power.

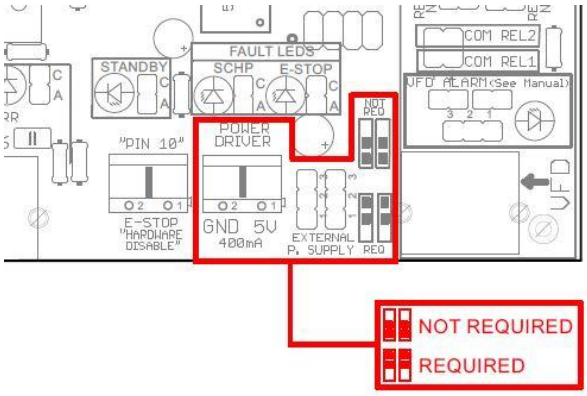


If isolation is not required, don't connect any external power supply to these terminals and set jumpers in "NOT REQUIRED" position.

4.2 Power terminals and Jumper for Driver monitor circuit

Connects an external (5V) power supply, when using drivers with error or alarm signal common to its power GND. In this case, set jumper in “REQ” position.

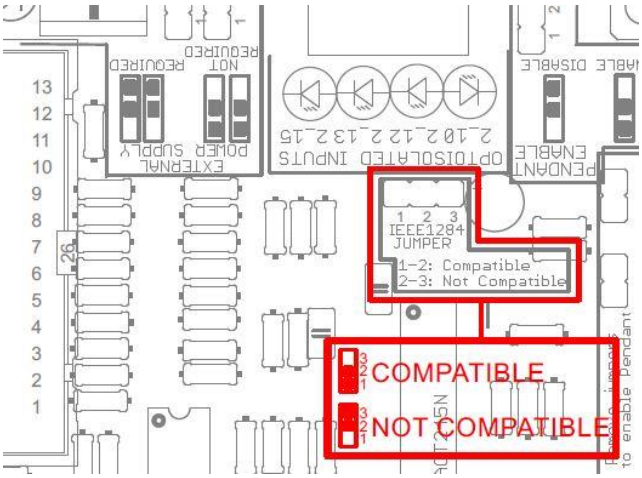
In other cases don't connect any power supply to those terminals and set jumpers in “NOT REQ” position.



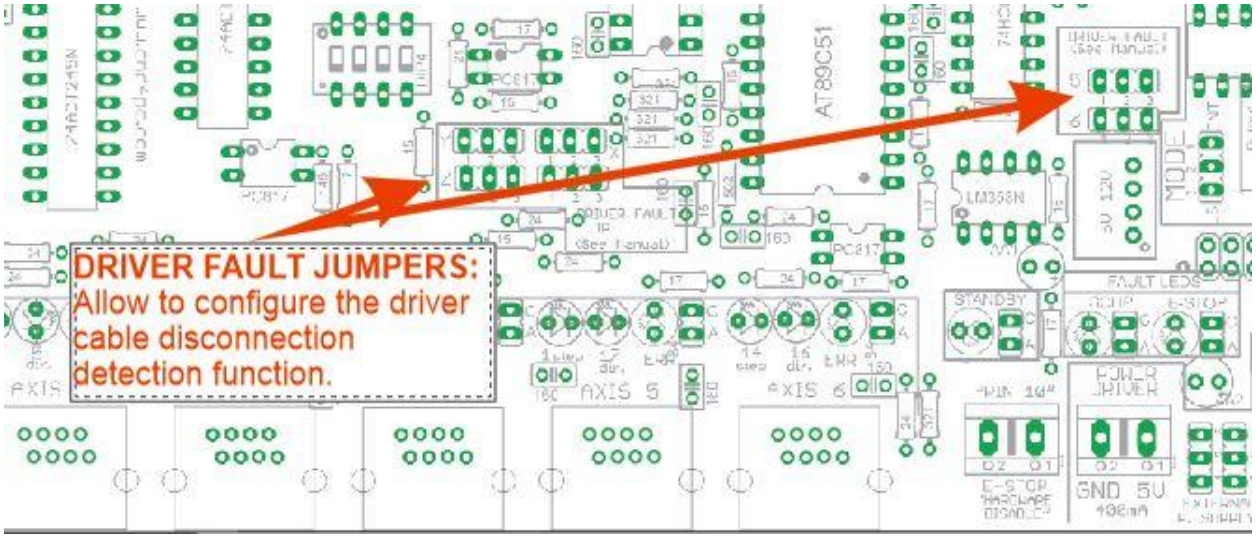
4.3 Controller selection jumpers (IEEE1284/SS)

If using a normal LPT port as control interface, set jumper in “compatible” position.

By other hand, if using a SS or an ESS as controller, set jumper in “Not compatible” position



4.4 Driver Fault Jumpers



Some C34 boards have a special circuit that allows to the C32 detecting when the C34 has been disconnected.
To enable this detection function is required set jumper of the axes to be used in 1-2 position. If the C34 does not include this disconnection detection circuit or this function is not going to be used, set all jumpers in 2-3 position (see the respective C34 User manual).
If this function is enabled and any C34 is disconnected, the C32 will go to standby mode and a driver error will be shown.

5.0 CONFIGURATION DIPSWITCH

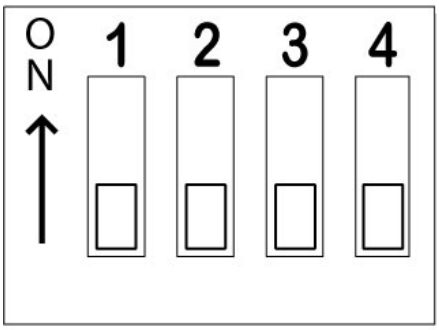
DIPSWITCH allows activating or deactivating the SCHP detection function, and selecting the driver to use and delays an enable signal for external devices.

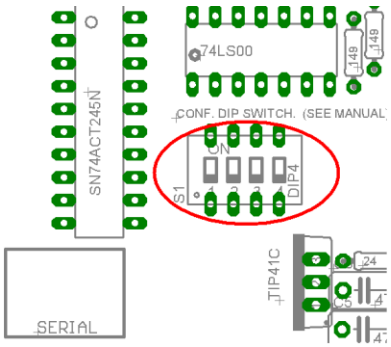
5.1 Position 1

The enable output (Pin 17-Port 2) will be activated when the driver enable process starts. A delay in the signal activation time could be added by selecting the OFF position in the DIPSWITCH.

The table below shows the delay time for each supported driver.

DRIVER	DELAY (Sec.)
G320/340	5
G203	2
G210/201/Keling	2
Viper Servo driver	5





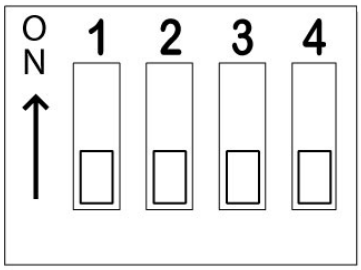
SWITCH 1 OFF: Delayed enable output (Pin 17-Port 2).
SWITCH 1 ON: Non Delayed enable output (Pin 17-Port 2).

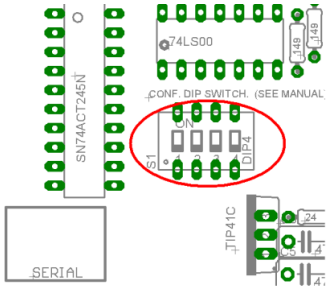
5.2 Position 2

Safety Charge Pump "SCHP". (Pin 17 "Port 2")
This board takes advantage of Mach ability to send a specific frequency through one of the pins of the parallel port when the program is in control of the system.

Selecting the SCHP operation mode

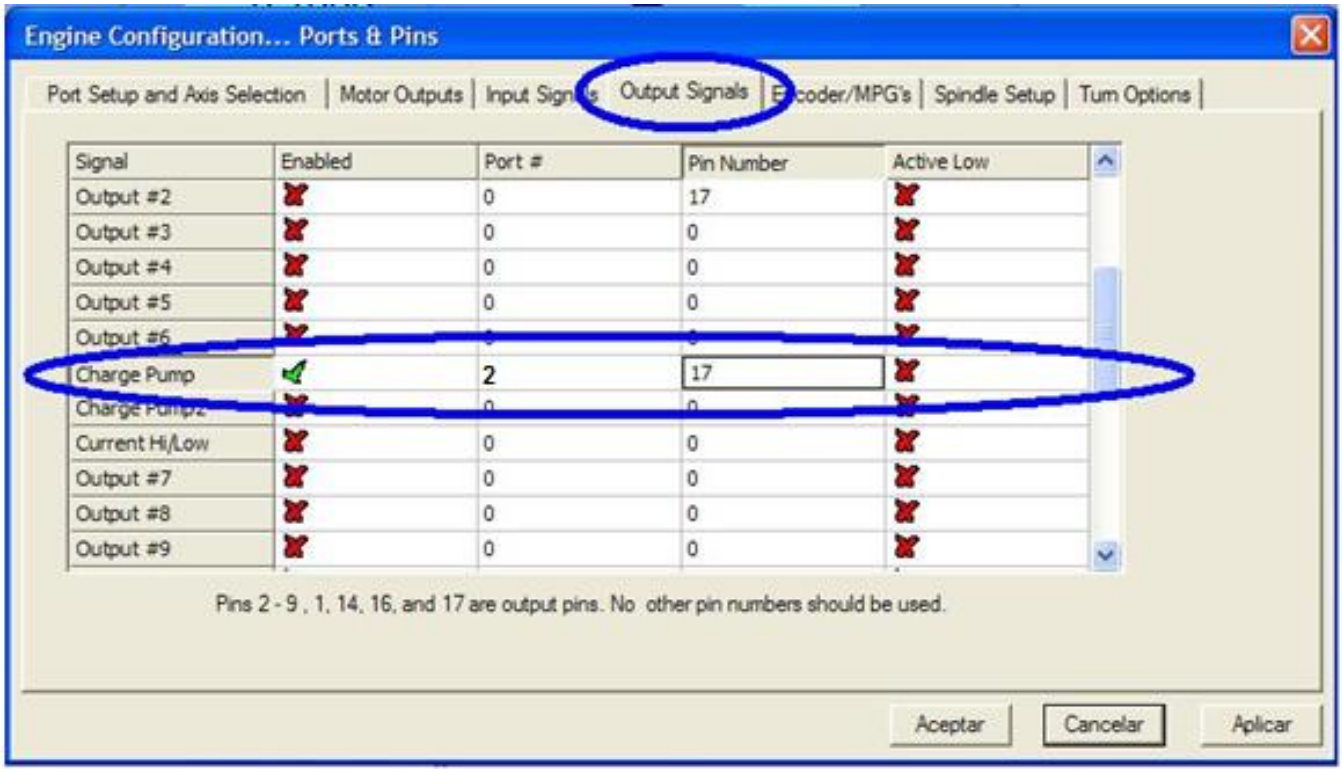
Onboard DIPSWITCH allows activating or deactivating the SCHP detection function.
SWITCH 2 ON: Activate the SCHP detection function.
SWITCH 2 OFF: Deactivate the SCHP detection function.





Note: When the Safety Charge Pump function is activated, 5V are present in the E-Stop terminal and a valid SCHP signal is present, Port 2 Pin 17 will go high. This high signal can be used to enable other external devices, such as enabling other Breakout Boards, or relays that would enable servos, VFDs, contactors, etc.…Variable Speed Control (pin 14 “Port 1”) and VFD connection.

For Configuring the *Charge Pump* in *Mach X*:
Use the dialog *Config / Ports and pins / Output Signals*. Enable the *Charge Pump* output and configure it as is shown in the Fig. 12 Next, press the *apply* button.



5.3 Position 3 and 4

Select the driver you will use according to the table below.

OPERATION MODE	COMPATIBLE DRIVER	DIP 3	DIP 4
Mode 1	G320/DG4S	0	0
Mode 2	G203	1	0
Mode 3	G210/201/Keling	0	1
Mode 4	Viper	1	1

This board includes a Microcontroller-based driver monitoring system. It performs enabling and monitoring functions for servo Drivers, and only enabling function for stepper drivers. It is required connect the driver ERR/RES (servo drivers) or EN (stepper driver) terminal to the pin 5 of each RJ45 driver connector.

Here is a brief description of how these functions are performed for each operation mode.

Operation Mode 1 (G320/DG4S)

When the system starts, the C32 error/reset pins go to a low state (0V), making sure the driver remains disabled. When SCHP and E-Stop function are checked and validated and there is no fault signal coming from any driver, the system sends a high (5V) to the driver's error/reset pins for about 5 seconds to enable the drivers. After that the system monitors the driver's err/res pins. If a fault occurs on any driver (0V in driver ERR/RES pin) or an external fault occurs (E-Stop or SCHP fault), the system stops and sends an e-stop signal (Active low) to the controller. All outputs on the board are disabled and the drivers will be disabled by sending a LOW (0V) to the drivers ERR/RES pin. The system will remain that way until the conditions to restart are present again.

Operation Mode 2 (G203)

When the system starts, the C32 enable pins go to a HIGH state (5V). When SCHP and E-Stop function are checked and validated, the system send a LOW (0V) to the driver's EN pin for about 2 Sec, enabling the drivers. If an external error occurs, the system stops, resets the CNC software and sends a HIGH (5V) to the drivers EN pin. The system will remain that way until the conditions to restart are present again.

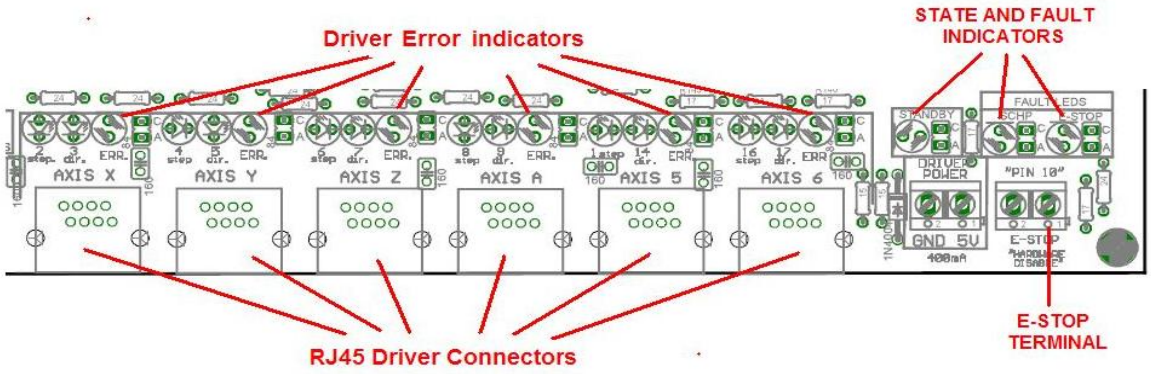
Operation Mode 3 (G210/201)

When the system starts, the C32 enable pins go to a LOW state (0V). When SCHP and E-Stop function are checked and validated, the system send a HIGH (5V) to the Drivers EN pin for about 2 Sec, enabling the Drivers. If an external error occurs, the system stops, resets the CNC software and sends a LOW (0V) to the drivers EN pin. The system will remain that way until the conditions to restart are present again.

Operation Mode 4 (Viper, Teco and Delta)
When the system starts, the C32 enable pins go to a low state (0V). When SCHP and E-Stop function are checked and validated and there is no fault signal coming from any driver, the system sends a high (5V) to the driver Fault output pin, enabling the drivers. After that the system monitors the driver's Fault Output pin. If an error is generated in any driver (0V in driver Fault Output pin) or an external error occurs, the system stops, resets the CNC software and sends a LOW (0V) to the drivers to ensure they remain disabled.

6.0 LED INDICATOR

The **standby LED** lights to indicate that the system is ready but disabled. When **Status LED,** (Green LED) lights, it indicates that the system is enabled.
There are 4 possible error sources: a driver fault, E-STOP error, SCHP error or VFD alarm. An LED will light close to the source of the fault.



7.0 VARIABLE SPEED CONTROL

Variable Speed Control allows controlling the spindle with PWM and direction signals, as if it was an axis motor. It converts the PWM signal into an analog (0-10VDC) signal.

A Variable Frequency Drive or Inverter works by modifying the frequency for AC motors. You can control most of these devices with an external analog signal (0-10VDC). That is, if there is 5VDC control signal, the motor will run at 50% of full speed, if there is 10VDC, the motor will run at 100% of full speed. If there is no voltage, then the motor will stop.

This function can also be used on many DC motor controllers by replacing the potentiometer that controls the speed.

WARNING: You will require a voltmeter to fine tune your system.
Before connecting anything, please be sure to read your VFD's manual and make sure you understand all the safety issues.

7.1 Operation Mode Selection Jumper

This jumper allows selecting the way how the relays are activated when a PWM signal and REV signal are present in the pins 1_14 and 1_16.

In US mode one relay is used to start on CW and the other one to start on CCW. In international mode one relay is used for on/off, and the other one to indicate the CW or CCW rotation of the spindle motor. This board uses the step and direction setting for the spindle motor under motor output in Mach3 to generate the required action on the relays. For both cases the presence of PWM will indicate spindle start.

See the tables below.

US MODE (INT)				
PIN		**RELAYS**		
1_14	***1_16***	***REL 1***	***REL 2***	***OPERATION***
PWM	1	OFF	ON	Spindle ON CCW
PWM	0	ON	OFF	Spindle ON CW
0	1	OFF	OFF	Spindle Off
0	0	OFF	OFF	Spindle Off

INTERNATIONAL MODE (INT)				
INPUTS		**RELAYS**		
1_14	***1_16***	***REL 1***	***REL 2***	***OPERATION***
PWM	1	ON	ON	Spindle ON CCW
PWM	0	ON	OFF	Spindle ON CW
0	1	OFF	OFF	Spindle Off
0	0	OFF	OFF	Spindle Off

Relay 1 and 2 (Pins 16 “Port 1”)
They can be used to control the VFD. The relay specifications are shown in the table below.

ELECTROMECHANICAL RELAYS SPECIFICATIONS	
Maximum Current (AC)	7A@240VAC; 10A@125VAC
Maximum Current (DC)	15A@24VDC; 10A@28VDC

RJ45 for VFD Connection

This RJ45 port let you make an easy connection between this board and the VFD.

RJ45 for VFD	
RJ45 PIN	**Function**
1	Analog GND
2	Analog Output
3	VFD Alarm **(NEW)**
4	REL 1 Normally Open Contact
5	Not Used
6	REL 2 Normally Open Contact
7	Ext. 12VDC or 24VDC
8	Relay Common

An. GND: Ground of the Analog output signal

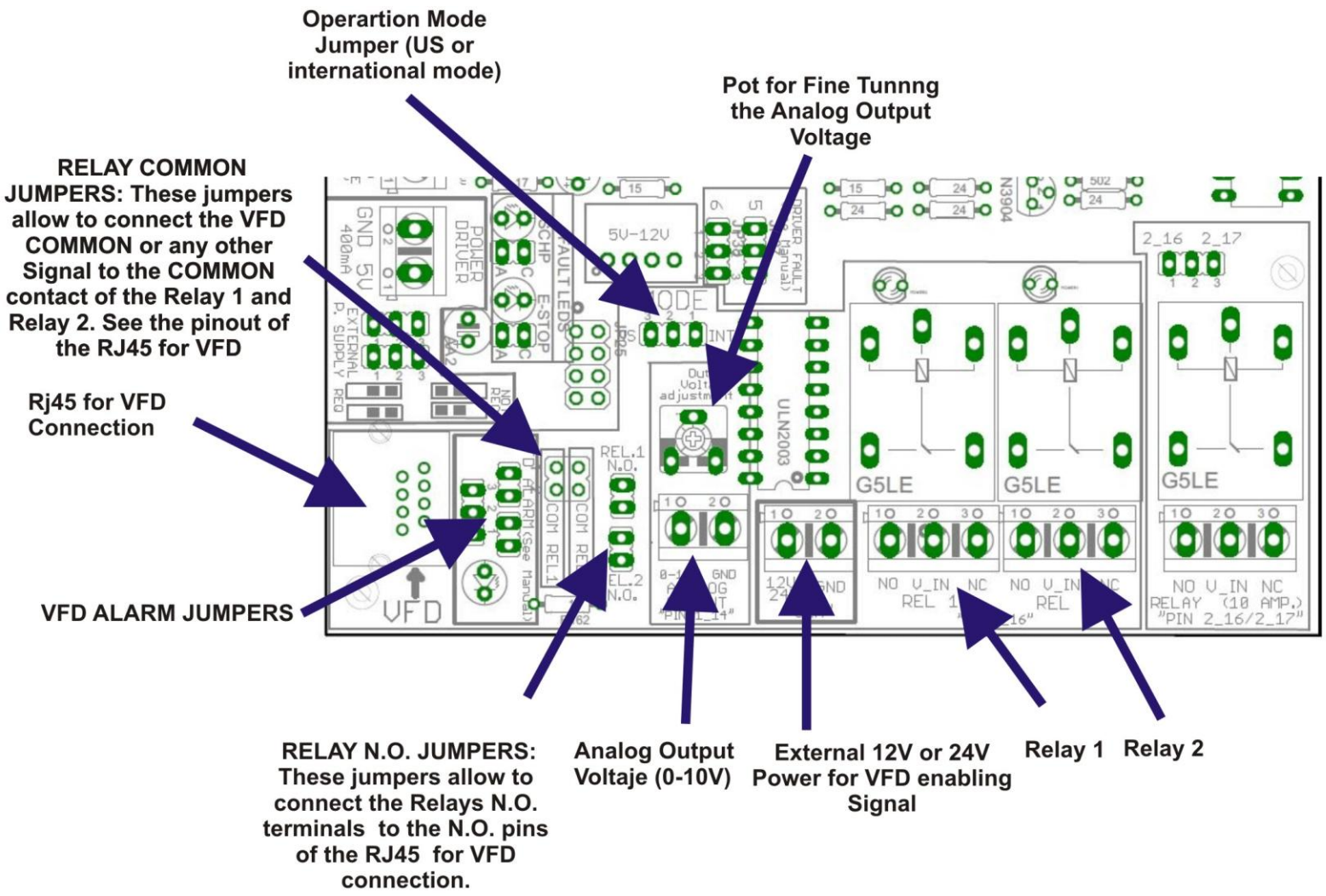
Analog Output: Isolated Analog Output Signal (0-10V)

VFD Alarm: Alarm signal generated by the VFD. (**See VFD ALARM JUMPERS section)**

Ext. 12VDC or 24VDC: External 12VDC or 24VDC power supply used to enable the VFD.

Relay Common: The signal or voltage wired to this terminal can be connected to the common terminals of the relay 1 and relay 2. Use the on-board RELAY COMMON JUMPERS to do this connection. Remove the jumper if this connection is not required.

VFD Connection and configuration jumpers

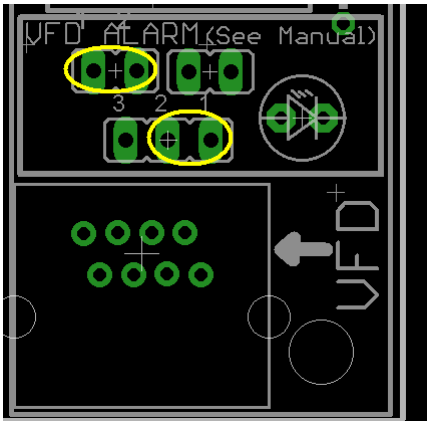

Operartion Mode Jumper (US or international mode)
Pot for Fine Tunnng the Analog Output Voltage
RELAY COMMON JUMPERS: These jumpers allow to connect the VFD COMMON or any other Signal to the COMMON contact of the Relay 1 and Relay 2. See the pinout of the RJ45 for VFD
Rj45 for VFD Connection
VFD ALARM JUMPERS
RELAY N.O. JUMPERS: These jumpers allow to connect the Relays N.O. terminals to the N.O. pins of the RJ45 for VFD connection.
Analog Output Voltaje (0-10V)
External 12V or 24V Power for VFD enabling Signal
Relay 1
Relay 2
G5LE
ULN2003
VFD

VFD Alarm jumpers

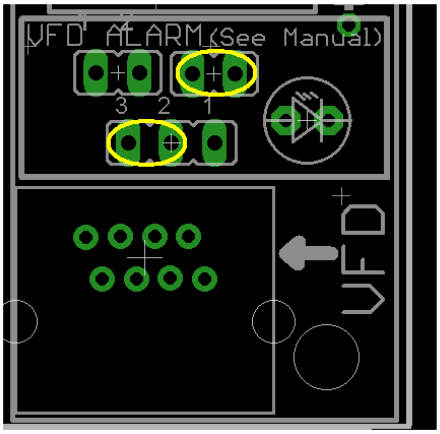
Many VFDs have general purpose relay that can be configured to generate an alarm (Use its N.C. contacts). This board takes advantage of this feature to monitor the VFD status.

The signal to monitor must be referenced to the **Analog GND.**

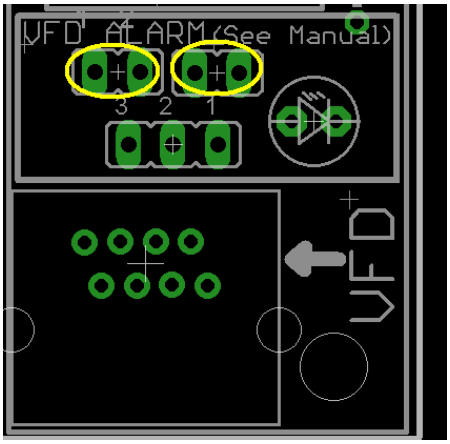
When the used alarm signal is “Analog GND”, set jumper as shown below



When the used alarm signal is a positive voltage referenced to “analog GND”, set jumper as shown below



If the VFD alarm monitoring function is not performed, set jumper as shown below

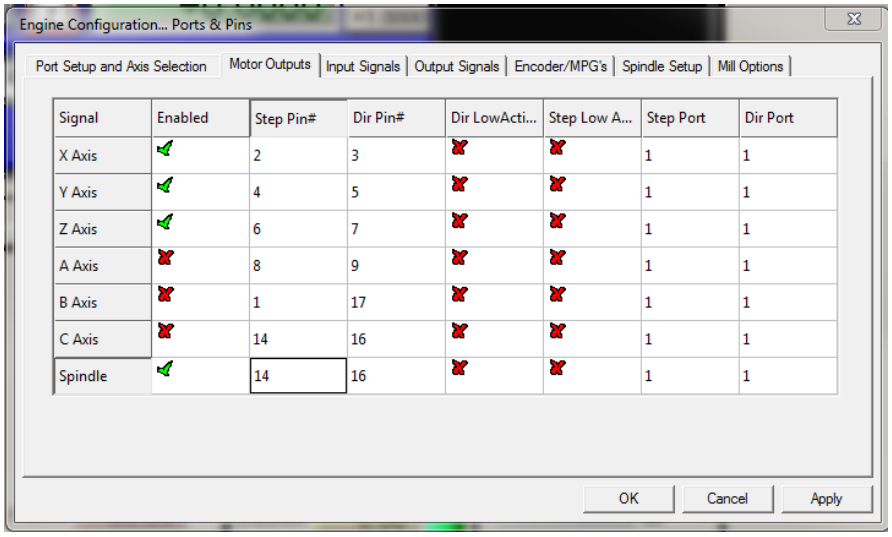


For additional wiring diagrams, check the bottom of this product's page:
http://www.cnc4pc.com/Store/osc/product_info.php?products_id=255

Configuring the Control Software:

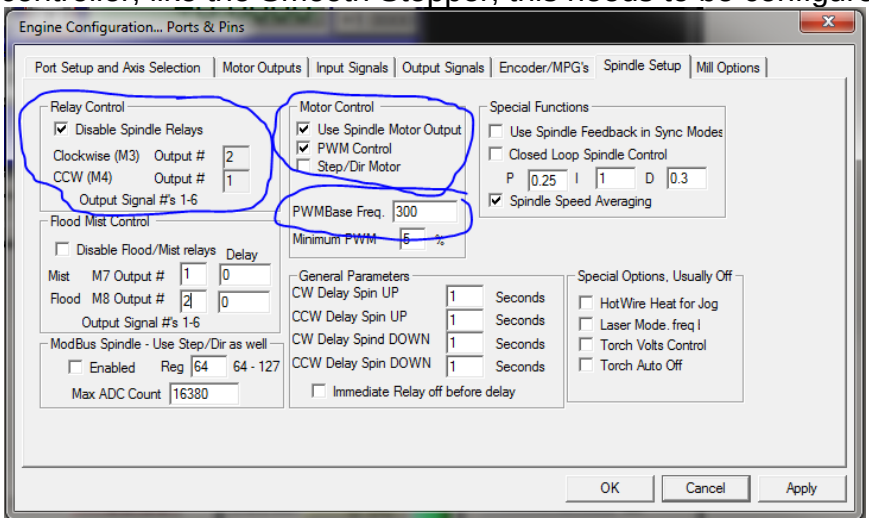
For configuring Mach X follow these steps:

Go to Config / Ports&Pins / Motor Outputs. Enable the spindle and select the port and pins you wired for step and direction.

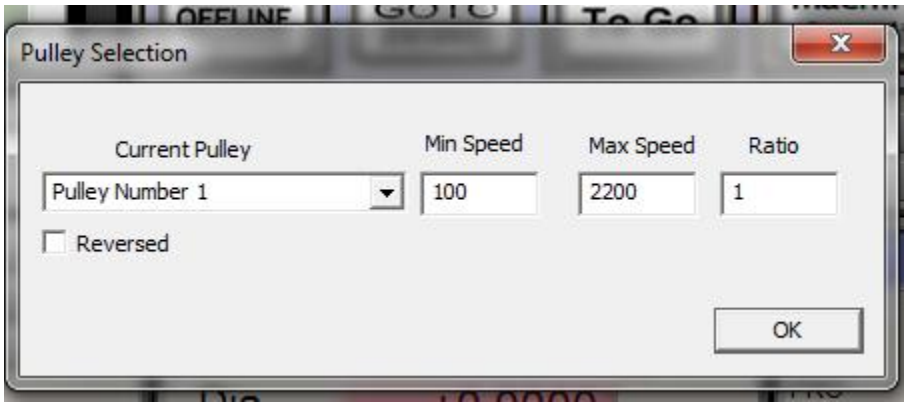


***Ports&Pins* configuration screenshot**

Go to Config / Ports&Pins / Spindle Setup. In the motor control box, check Use Spindle Motor Output and PWM Control with a frequency of 300Hz. If using an external motion controller, like the Smooth Stepper, this needs to be configured in the plugin too.

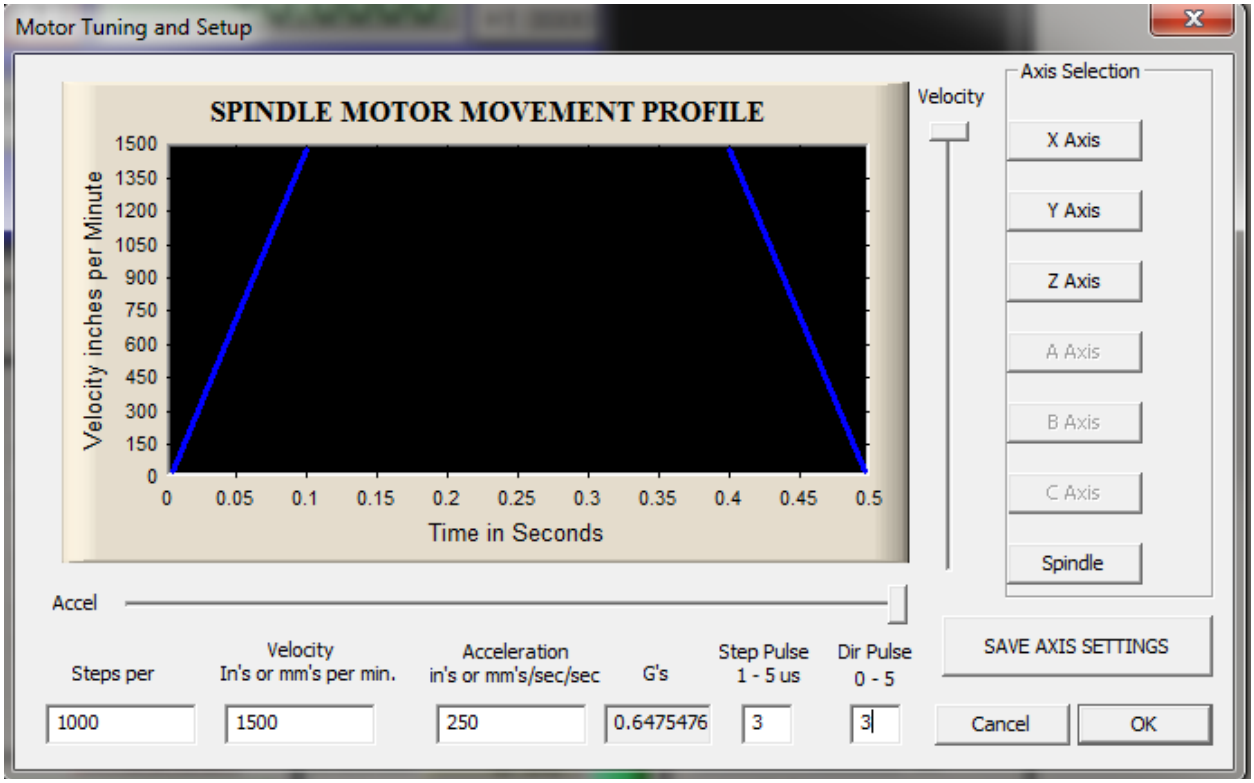


Under Pulley Ratios set the pulley ratios of the machine.



***Spindle Setup* screenshot**

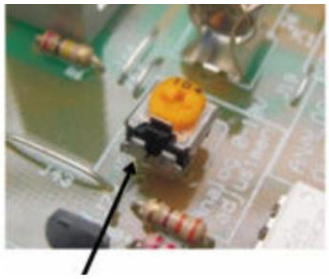
Go to Config / Motor Tuning / Spindle. Set the velocity and acceleration to the max.



***Motor Tuning and Setup* screenshot**

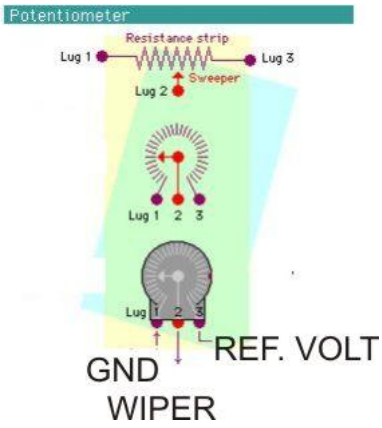
After configuring the Mach, these steps should be followed.

Connect a multimeter to the analog output terminals to fine tune the analog output. Comment the spindle to go at max speed and make sure you get +10vdc. To adjust it you can play with the potentiometer or the max speed you have set under motor tuning.



Pot for fine tuning the analog 0-10vdc output

Replacing a Potentiometer:



This circuit can be used to replace a potentiometer of a DC motor speed control circuits. This speed controller circuits are very commonly used by SIEG, KB Electronics, and many other Asian machines. Before explaining how to do it, please first keep in mind that it can be done if the voltage that goes though the pot is +12vdc or less. This circuit cannot be used for AC currents.

In most cases the terminals that go to the potentiometer will carry these signals:
P1 = GND
P2 = WIPER
P3 = REFERENCE VOLTAGE
These are the steps for replacing a potentiometer:

Measure the voltage difference between P1 and P3. Make sure it measures under +12vdc.
Fine tune the analog output to the output voltage you got from step 1.
Connect the ground from the analog output to the ground of the potentiometer (P1).
Connect the analog output to the wiper connection of the potentiometer (P2).

8.0 PINOUT

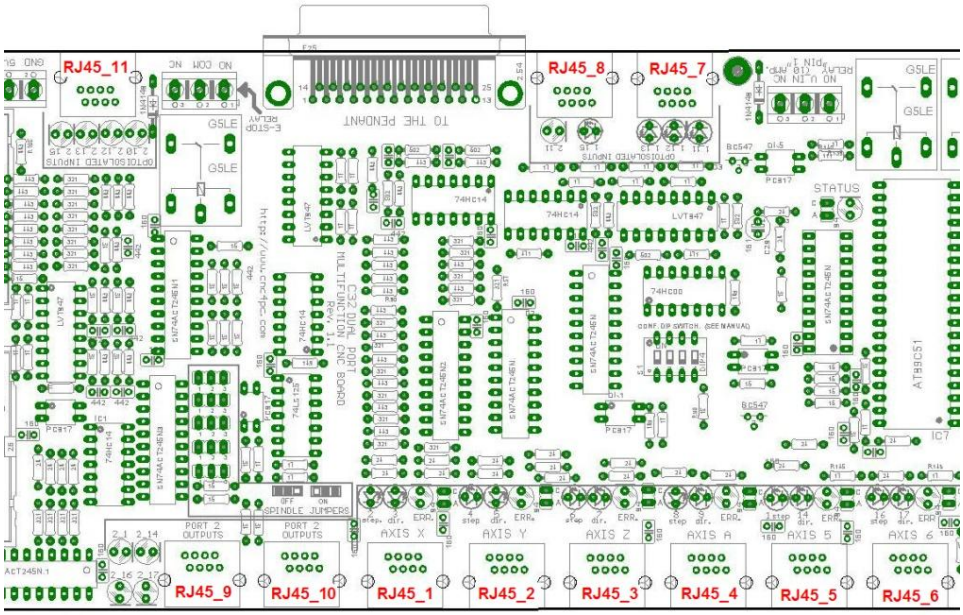


Fig. 9*RJ45 Distribution*

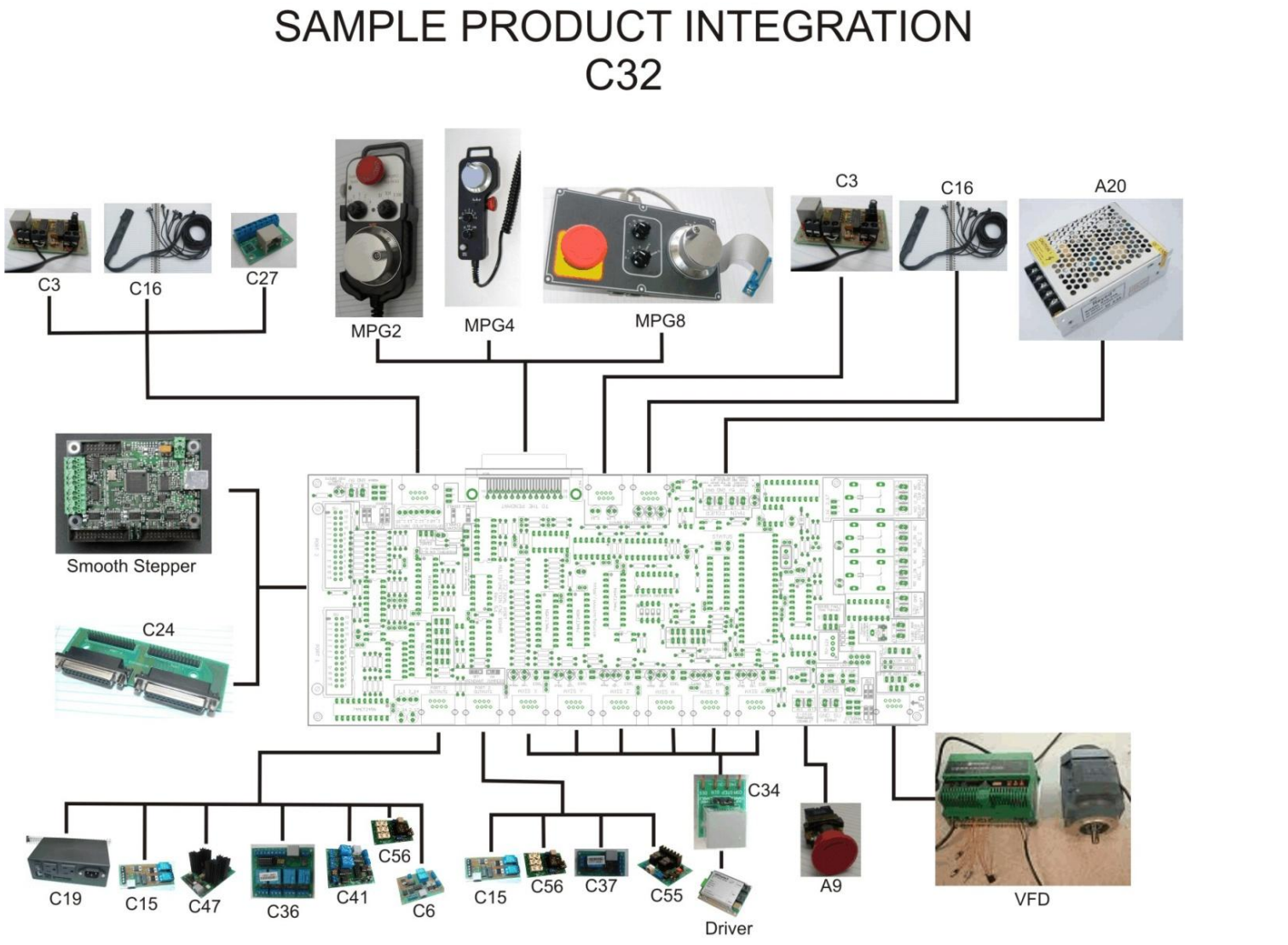
RJ45_1		RJ45_2		RJ45_3		RJ45_4		RJ45_5		RJ45_6	
RJ45 PIN	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**
1	NC	1	NC	1	NC	1	NC	1	NC	1	NC
2	1_2 (Step X)	2	1_4 (Step Y)	2	1_6 (Step Z)	2	1_8 (Step A)	2	1_1 (Step 5)	2	1_14 (Step 6)
3	NC	3	NC	3	NC	3	NC	3	NC	3	NC
4	GND	4	GND	4	GND	4	GND	4	GND	4	GND
5	Err/res X	5	Err/res Y	5	Err/res Z	5	Err/res A	5	Err/res 5	5	Err/res 6
6	1_3 (Dir. X)	6	1_5 (Dir. Y)	6	1_7 (Dir. Z)	6	1_9 (Dir. A)	6	1_17 (Dir. 5)	6	1_16 (Dir. 6)
7	NC	7	NC	7	NC	7	NC	7	NC	7	NC
8	5V	8	5V	8	5V	8	5V	8	5V	8	5V
Supported connection		**Supported connection**		**Supported connection**		**Supported connection**		**Supported connection**		**Supported connection**	
G320/G340		G320/G340		G320/G340		G320/G340		G320/G340		G320/G340	
G203		G203		G203		G203		G203		G203	
G210/G201		G210/G201		G210/G201		G210/G201		G210/G201		G210/G201	
Viper Servomotor		Viper Servomotor		Viper Servomotor		Viper Servomotor		Viper Servomotor		Viper Servomotor	
Servo or Stepper Driver		Servo or Stepper Driver		Servo or Stepper Driver		Servo or Stepper Driver		Servo or Stepper Driver		Servo or Stepper Driver	

RJ45_7		RJ45_8		RJ45_9		RJ45_10		RJ45_11	
RJ45 PIN	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**	**RJ45 PIN**	**P.P. PIN**
1	GND_EXT	1	GND_EXT	1	GND	1	GND	1	GND_EXT
2	1_13	2	NC	2	2_17	2	NC	2	2_15
3	1_12	3	E-STOP	3	2_16	3	NC	3	2_13
4	1_11	4	2_11	4	2_1	4	2_16	4	2_12
5	NC	5	1_15	5	2_14	5	2_17	5	2_10
6	NC	6	NC	6	NC	6	NC	6	NC
7	5V_EXT	7	5V_EXT	7	5V	7	5V	7	5V_EXT
8	2_16	8	NC	8	NC	8	NC	8	NC
Supported connection		**Supported connection**		**Supported connection**		**Supported connection**		**Supported connection**	
C16, A32, C45, A61		C3, C48		C19, C15, **C5**, **C8, C9**, C47, C41, C6,C36, C54, C55, C56		C15, C8, C9, C55, C56		General Porpuse Isolated inputs	

M_N: Parallel port or Smooth Stepper pin, where M is the port number and N is the pin number.

* When connecting optoisolated boards, a connection between the ground of the C32 and the board must be used. This is the case for the C15 and C19.

9.0 WIRING SAMPLE



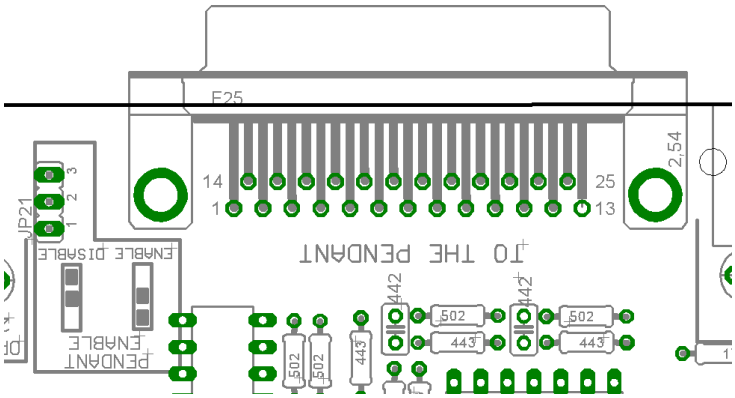
Note: This wiring is just to illustrate a sample product application. Specific wiring may vary from system to system. It is the user's responsibility to implement it correctly.

For More Information

http://www.cnc4pc.com/Store/osc/product_info.php?products_id=255

10.0 CONNECTING A PENDANT

Set the *pendant enable jumper* in ENABLE position if a pendant is connected to the DB25 connector.



Pins 2_10, 2_11, 2_12, 2_13 and 2_15 are able to be used with the pendant (DB25 connector) or as general use input pin (RJ45 connector). Set the *Pendant ON/OFF selection jumper* in ON position if a pendant is connected to the DB25 connector. Otherwise set jumpers in OFF position.

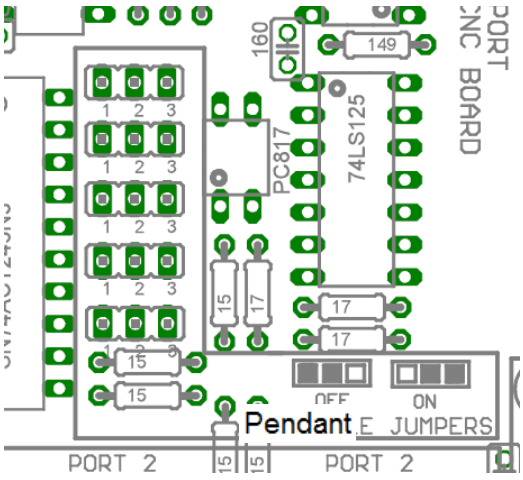
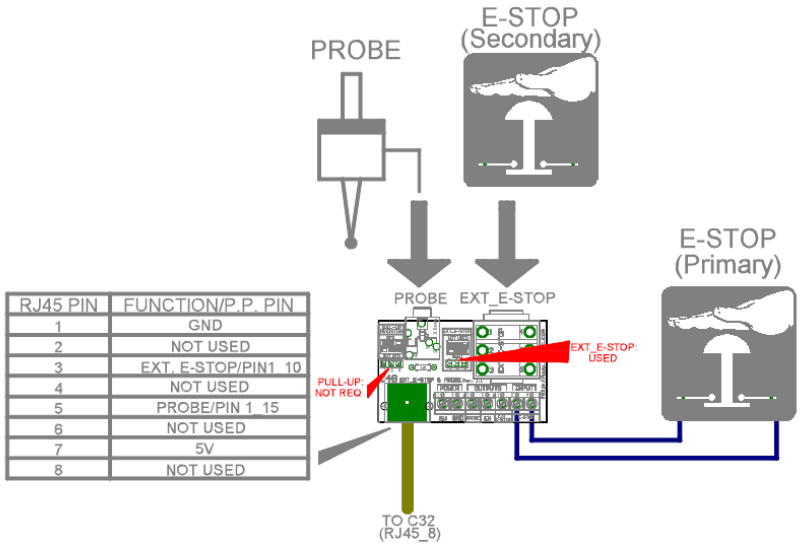


Fig. 9 Pendant ON/OFF selection jumper

Note: Pins (2_2 - 2_9) are configured as inputs and they are only accessible through the DB25 for Pendant.

CONNECTING A C48

RJ45_8 provides an easy way to wire an External Probe and an external (Secondary) E-Stop. Image below shows a wiring sample for this connection

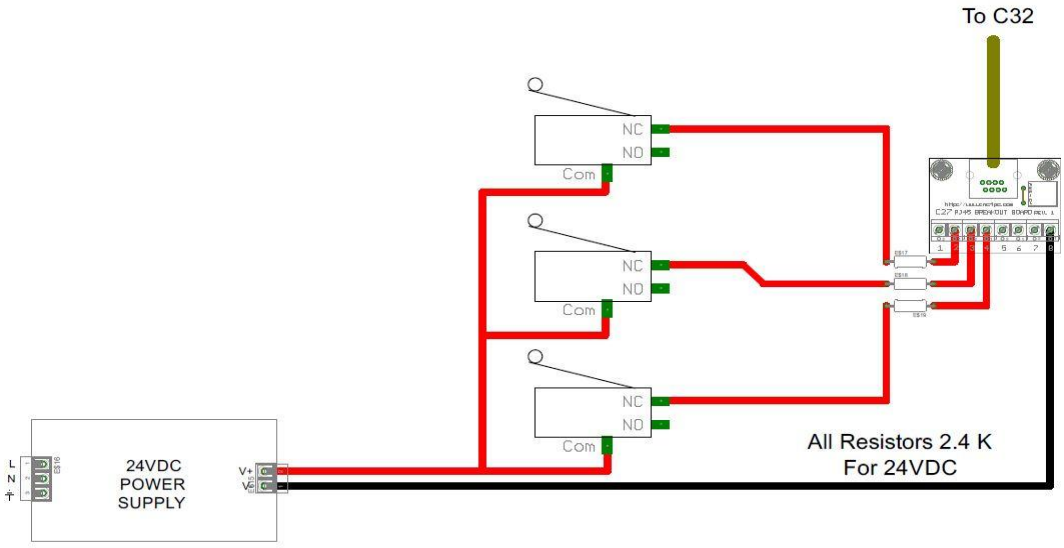


RJ45 PIN	FUNCTION/P.P. PIN
1	GND
2	NOT USED
3	EXT. E-STOP/PIN1_10
4	NOT USED
5	PROBE/PIN 1_15
6	NOT USED
7	5V
8	NOT USED

Note: The primary E-stop can be connected to C32 E-Stop terminals or to the C48 E-Stop input terminals.

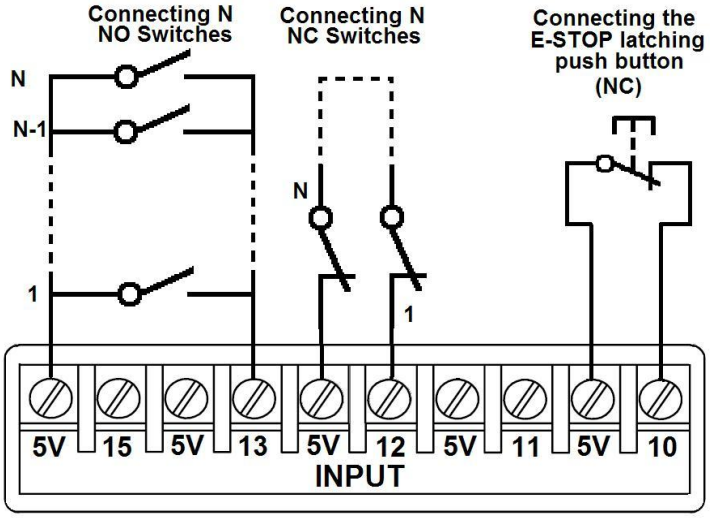
11.0 WIRING DIAGRAMS

This connection is for signals of 24VDC, allows what inputs signals can be to 24V. This requires limiting resistors.

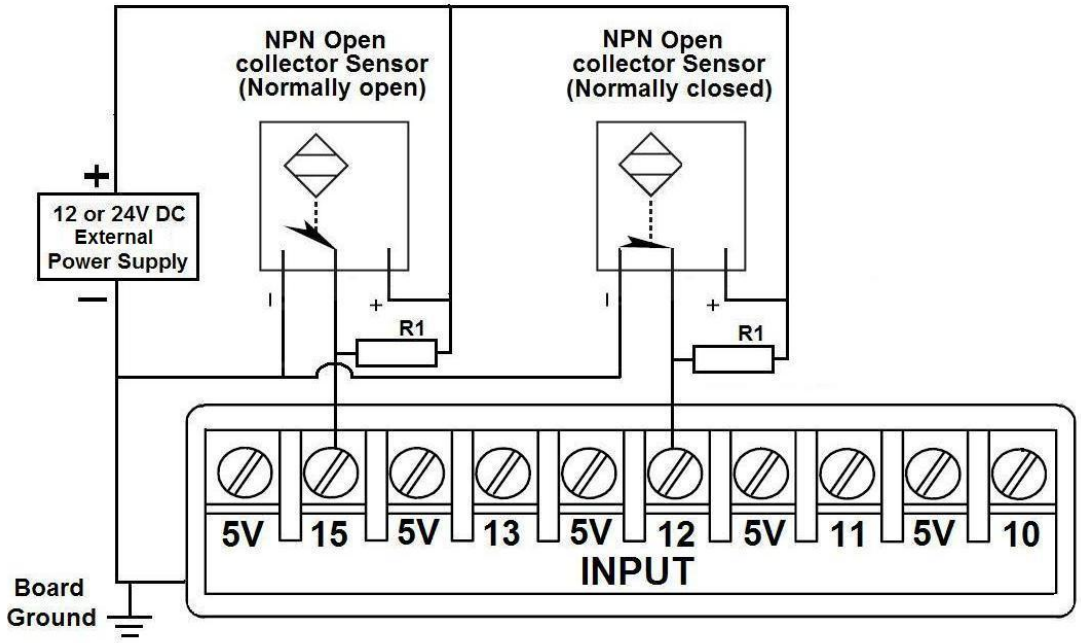


Wiring diagram to connect switches with 24VDC power supply

While this board supports only TTL +5VDC signals, different kind of sensors and switches using different voltages can be connected using the diagrams that follow:
Note: The below wiring diagrams are an example, any input can be used for the connections.

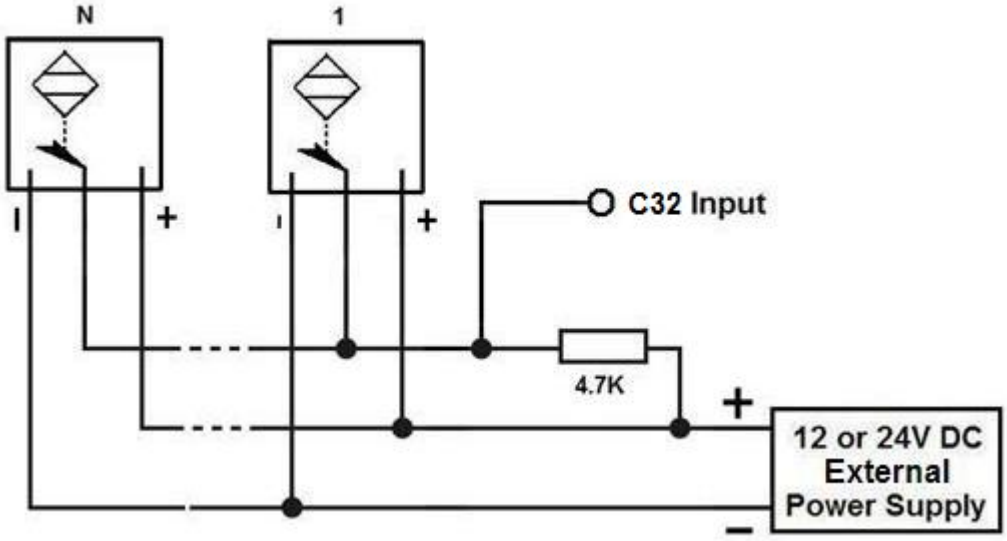


Wiring diagram to connect switches

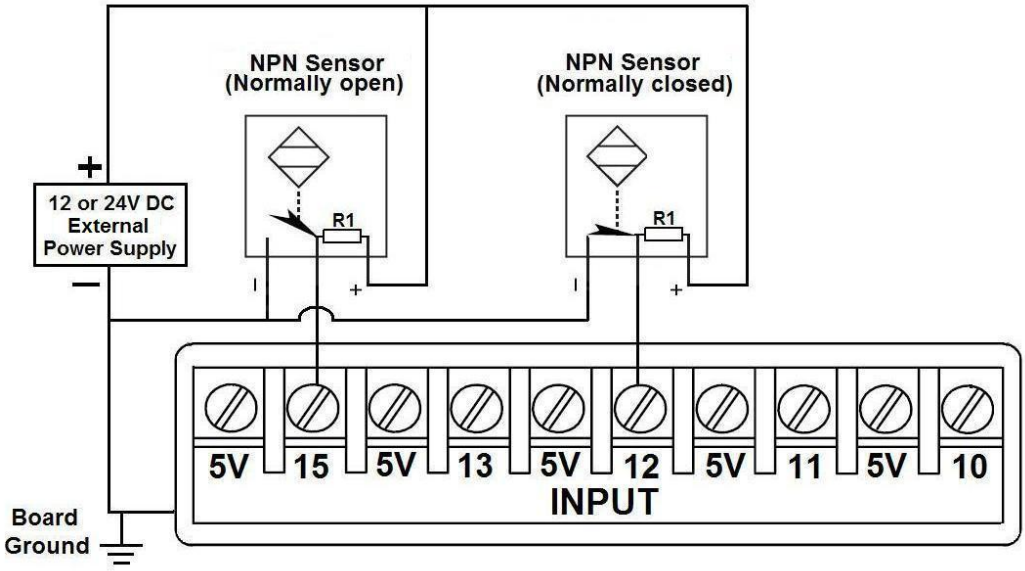


Wiring diagram to connect NPN open collector proximity sensors

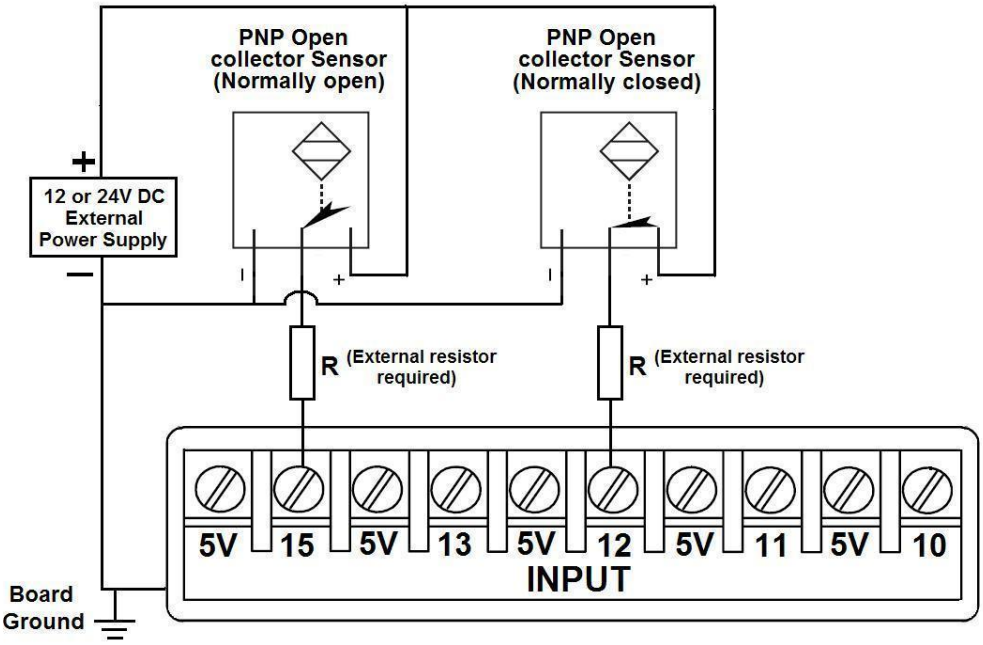
For a 24V or 12V sensor, the recommended value for the external resistor R1 is 4.7K Ohm.



Wiring diagram to connect in parallel NPN open collector proximity sensors



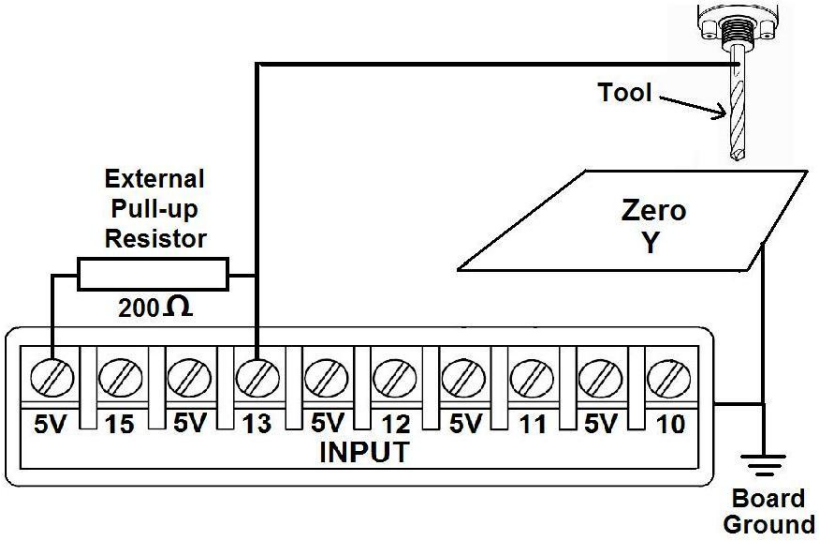
Wiring diagram to connect NPN proximity sensors with internal pull up resistor


PNP Open collector Sensor (Normally open)
PNP Open collector Sensor (Normally closed)
+
12 or 24V DC External Power Supply
–
R (External resistor required)
R (External resistor required)
5V 15 5V 13 5V 12 5V 11 5V 10
INPUT
Board Ground

Wiring diagram to connect PNP open collector proximity sensors

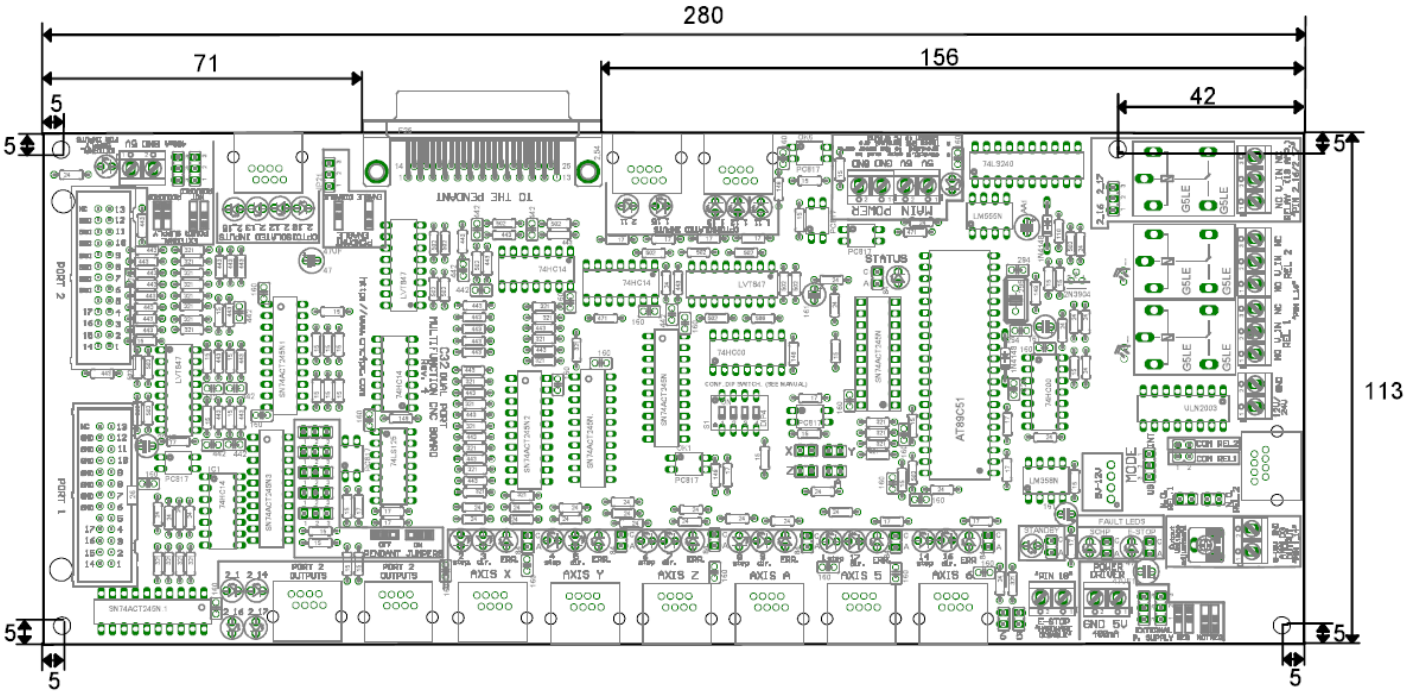
Connecting PNP open collector proximity sensor with the C32 Rev.3		
Board	**R Value (12V)**	**R Value (24V)**
C32 Rev. 3	470Ω	1KΩ

Table 15 R value to Connect PNP open collector proximity sensor with the C33.



Wiring diagram to do an "Auto Tool Zero"

12.0 DIMENSIONS



All dimensions are in Millimeters.

Disclaimer:

Use caution. CNC machines can be dangerous machines. Neither DUNCAN USA, LLC nor Arturo Duncan are liable for any accidents resulting from the improper use of these devices. This product is not a fail-safe device and it should not be used in life support systems or in other devices where its failure or possible erratic operation could cause property damage, bodily injury or loss of life.